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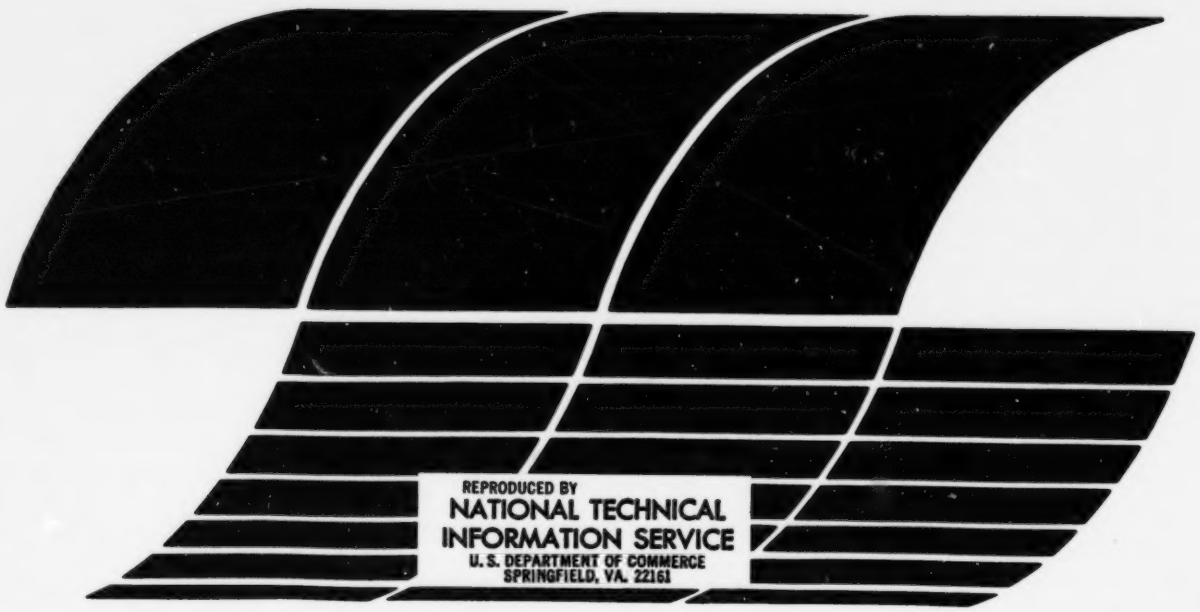
Interagency Energy/Environment R&D Program Report



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16. ABSTRACT The report is the second annual report on the Fine Particle Emissions Information System (FPEIS), a computerized data base on primary fine particle emissions from stationary sources. The report summarizes new data added to the FPEIS during 1979 and outlines objectives for 1980 including the emergence of the Environmental Assessment Data Systems (EADS). The FPEIS provides a centralized inventory of fine particle measurement information for researchers engaged in fine particle control technology development and in the environmental assessment of energy and industrial processes. The first (1978) annual report on FPEIS reported 120 test sites in the data base. By the end of 1979, 47 new test sites had been added to the data base and the total of sampling runs had increased to over 2800.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Pollution Control	13B	
Dust	Stationary Sources	11G	09B
Emission	Particulate	14B	06A
Assessments	Fine Particle Emissions Information System		06E
Industrial Processes		13H	
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by

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PREFACE

This report was prepared for the Environmental Protection Agency Industrial Environmental Research Laboratory in Research Triangle Park, North Carolina, under Contract No. 68-02-2641 (MRI Project No. 4396-L). The Environmental Protection Agency project officer was Mr. Gary L. Johnson.

The work was performed in the Environmental Systems Department of Midwest Research Institute. Mr. M. P. Schrag, Director of the Department, served as program manager, and Mr. J. Patrick Reider, Associate Environmental Engineer, served as project leader.

This report was written by Mr. Reider and Dr. R. F. Hegarty of Midwest Research Institute. The authors appreciate the contributions made to the program by Mr. T. Sutikno, Assistant Engineer, Mr. F. N. Young of MRI Systems, Inc., and Mr. Gary L. Johnson, the EPA Project Officer.

Approved for:

MIDWEST RESEARCH INSTITUTE

M P Schrag

M. P. Schrag, Director
Environmental Systems Department

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SECTION 1.0

INTRODUCTION

The Fine Particle Emissions Information System (FPEIS) is a computerized data base which contains information on primary fine particle emissions from stationary sources. The purpose of the FPEIS is to provide a centralized source of fine particle sizing data for use by engineers and scientists engaged in particulate control technology development and in the environmental assessment of energy and industrial processes. Following several months of testing and development, the FPEIS was declared operational in January 1977 and has since become a source of particle sizing data routinely used by various offices of the Environmental Protection Agency (EPA), contractors, and others.

In May 1979, the first FPEIS Annual Report was published. It reviewed and discussed data base activities in 1978. The purpose of this annual report is to describe the changes made to the FPEIS during 1979 and to outline plans for further development of the FPEIS data base in 1980.

1.1 ORIGIN OF THE FPEIS

To describe the evolution of the FPEIS to its present form, it is necessary to examine briefly its origin. Development of the FPEIS was initiated in early 1975 principally to update the Fine Particle Emissions Inventory (1) which had been developed by Midwest Research Institute (MRI) for EPA in 1971. In the years following publication of the Fine Particle Emissions Inventory, several questions had been raised about the validity of the data since there were limitations in the then-existing sampling techniques. Advances in particle sizing measurement technology and growth in fine particle sampling activities prompted EPA's Industrial Environmental Research Laboratory at Research Triangle Park, North Carolina (IERL/RTP) to initiate a comprehensive revision of the MRI Fine Particle Emissions Inventory.

Early in the inventory revision work, the decision was made to develop a computerized inventory; thus, the concept of the FPEIS was born. In addition to fine particle sizing data, the FPEIS was designed to contain a broad, yet comprehensive description of the entire sampling activity. This description included source process information, control device characteristics, discussion of the sampling equipment or methods used to collect the data, and the

results of any physical, chemical, or biological analyses performed on the collected samples. Such data enabled the user to evaluate more effectively the emissions data relative to specific user objectives. For orderly and rapid retrieval of information and for compatibility with other EPA data bases, the FPEIS used the same source categorization scheme as was used in the National Emissions Data System (NEDS) (i.e., the Source Classification Codes) (2). Also, the FPEIS utilized the SAROAD/SOTDAT (3) pollutant codes to describe the chemical species identified. In addition, a standard protocol for terminology and units was established for selected data not addressed by other existing data systems to be stored in the FPEIS. This protocol has since been modified to reflect changes in user requirements.

During the past 4 years, extensive documentation on the FPEIS has been issued to the data base user community. The first set of documents, which included the FPEIS User Guide (4) and the FPEIS Reference Manual (5), was published in June 1976. That first edition of the documentation, which described in detail the use of the FPEIS, was widely distributed. A second edition that completely replaced the first one was published in June 1978 and received even wider interest and distribution.

From the time that the FPEIS became operational in January 1977 and through December 1979, the FPEIS has experienced steady growth in the number and diversity of its users and in the quantity of information stored. Requests for information from researchers, academicians, and others have numbered in excess of 10 per month for the last 3 years. In those 36 months, the number of site tests reported has tripled, and the number of sampling runs has increased substantially. This increase reflects the growth of R&D interest in fine particle emissions and their control. Indications are that this growth will continue as environmental considerations related to particle sizing evolve into regulations.

1.2 ORIGINAL FPEIS DATA BASE STRUCTURE AND ORGANIZATION

The basic FPEIS data set may be defined as a group of discrete sampling events which describes fine particle sizing activities on a single particle-laden gas stream at a specified site and for a specified period of time. This data set is called a test series. Each FPEIS test series is identified by a unique test series number by which it may be referenced in the data base. In the most basic sense, the test series describes a site test. Consideration of the time period of the testing is imposed to differentiate among separate tests at the same site.

The fundamental unit of the data structure is the test run, which describes a single, discrete sampling event with a specified measurement instrument or technique. Since it is commonplace to group data according to the

sampling location, e.g., control device inlet or outlet, or according to variations in process conditions, the test runs are grouped into test subseries. This provides a more orderly sorting or retrieval of data. The designation of a test subseries may vary among test series and is left to the discretion of the encoder of the data. The structure of the FPEIS as it was originally conceptualized is given in Figure 1.1, which shows the groups of data types by structural level.

Originally, the FPEIS data were grouped in five general categories, as shown in Table 1.1. These categories included source characteristics and test series information; control system description; process characteristics; biological, physical, and chemical analyses; and particle size measurement equipment and data. Table 1.1 also identifies the specific data elements contained in each group of data when the data base was established. Many of the original data elements have since been changed or deleted, and other data elements have been added as the FPEIS has evolved.

1.3 REVISED FPEIS DATA BASE

The FPEIS was intended to provide a central source of fine particle size distribution data for use by engineers and scientists engaged in particulate control technology development and in the environmental assessment of energy systems and industrial processes. Even though the FPEIS is only 3 years old, it has been extremely well received by the user community. This acceptance of the importance of the FPEIS led to a desire on the part of EPA and other users for similar data bases covering solid, liquid, and gaseous emissions.

With FPEIS as the model, the Environmental Assessment Data Systems (EADS) were developed as a group of independent, computerized data bases interlinked to provide common accessibility to data produced by a variety of EPA projects. The FPEIS, of course, was the first of the data bases in EADS. The others are the Gaseous Emissions Data System (9) (GEDS), the Liquid Effluents Data System (10) (LEDS), and the Solid Discharge Data System (11) (SDDS). The FPEIS was used as a basic model for the other data bases, but its structural organization, designed as it was for fine particle emissions data, was not flexible enough to handle in a proper manner data expected for the other data systems. Since all of the data bases in EADS were to be interlinked, a major restructuring of FPEIS was performed rather than trying to force the other data base systems into the FPEIS structure. The restructuring was accomplished in 1979.

The EADS/FPEIS structure consists of four levels: test series, effluent stream design, test operating, and the sample, as shown in Figure 1.2. The test series level, the uppermost level when taken in its broadest contest, designates the sampling activities performed at a single site over a specified period of time. Next is the effluent stream design level where each stream that has been sampled is fully described with regard to the stream and

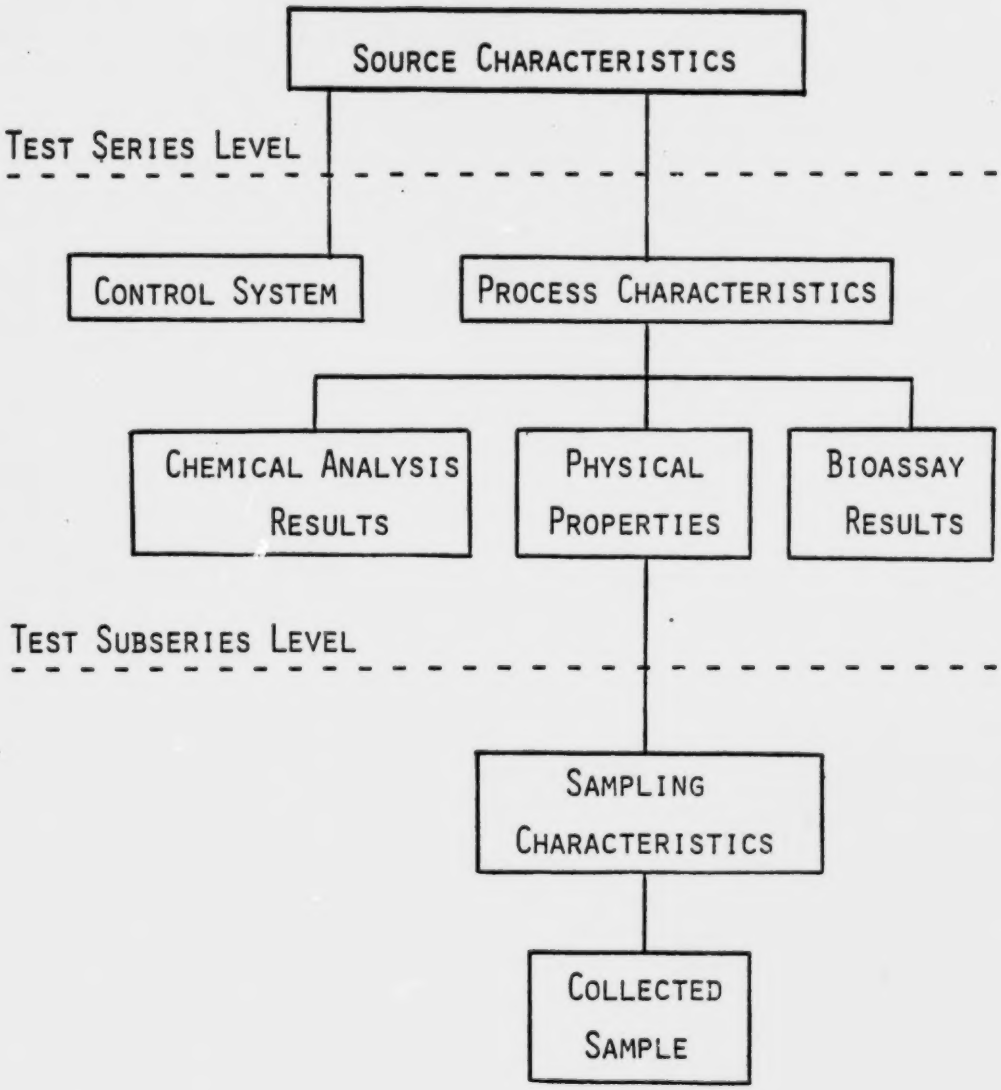

Figure 1.1. Original FPEIS conceptual structure.

TABLE 1.1 ORIGINAL FPEIS DATA ELEMENTS

1. SOURCE CHARACTERISTICS
   - Source Category
   - Type of Operation
   - Feed Material Class
   - Operating Mode Class
   - Source Name
   - Site Name
   - UTM Zone Location and Coordinates
   - Source Address (Street, City, State, Zip Code)
   - Test Series Remarks
2. CONTROL DEVICES
   - Generic Device Type
   - Device Category
   - Device Commercial Name
   - Manufacturer
   - Device Description
   - Design Spec. - Type and Value
   - Operating Parameter - Type and Value
3. PROCESS CHARACTERISTICS
   - Subseries Number
   - Subseries Test Date
   - Subseries Start and Finish Time
   - Sampling Location and Description
   - Source Operating Mode
   - Source Operation Rate
   - Feed Material Composition
   - Volumetric Flow Rate
   - Gas Temp. and Pressure at Samp. Loc.
   - Moisture Content
   - Percent Isokinetic Sampling
   - Gas Composition
   - Trace Gases in ppm
   - Subseries Remarks
4. BIOASSAY TESTING, CHEMICAL ANALYSES PHYSICAL PROPERTIES
   - Mass Train--Total Mass Conc.
   - Mass Train--Front Half Mass Conc.
   - Mass Train Comments
   - Bioassay Test Type
   - Bioassay Test Remarks and Results
   - SAROAD Chemical ID
   - Chemical Analysis Method
   - Conc. in Range above 10 μm
   - Conc. in Range 10 to 1 μm
   - Conc. in Range 1 to 0.1 μm
   - Conc. in Range 0.1 to 0.01 μm
   - Conc. in Range Below 0.01 μm
   - Filter/Total Concentration
5. PARTICLE SIZE EQUIPMENT AND DATA
   - Run Number
   - Measurement Equipment Type
   - Size Range Lower and Upper Limit
   - Substrate
   - Sampling Start Time and Duration
   - Sampling Flow Rate
   - Dilution Factor
   - Sampling Train Temp. and Pressure
   - Percentage Moisture
   - Particle Diameter Basis
   - Concentration Basis
   - Upper Diameter Boundary
   - Density - Value and How Determined
   - Resistivity - Value and How Determined
   - Physical Properties Comments
   - Run Comments
   - Diameter Boundary
   - Concentration

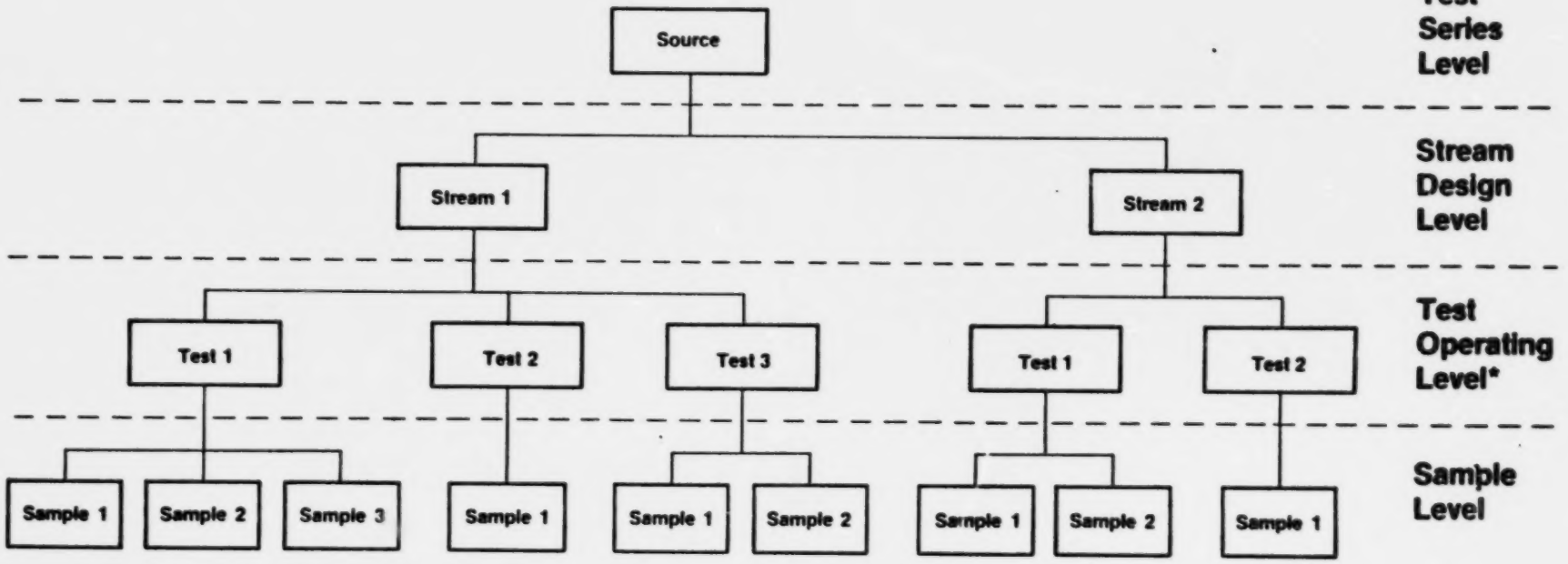

Figure 1.2. Revised FPEIS structure.

control device design parameters. The test operating level is where the source operating conditions are defined along with a complete characterization of the fuels and feedstocks used. The last level of the revised EADS/FPEIS structure is the sample level, which details each discrete sample with complete physical, chemical, radionuclide, and bioassay analysis data.

As shown in Table 1.2, the present FPEIS organization is based on four levels instead of three. The fourth level reports comprehensive analytical data including laboratory quality assurance and quality control information. With the addition of the fourth level, the FPEIS now contains data with a much greater degree of comprehensiveness and descriptiveness. This added detail reflects an increased need by the user community for complete characterization of the aerosol. The rationale behind these changes and the specifics of each change are discussed in Section 2 of this report.

Another edition of the FPEIS documentation, superceding all previous documentation, will be issued in May 1980. The key documents are the EADS: FPEIS User Guide (6), EADS: Systems Overview Manual (7), and the EADS: Terminology Reference Manual (8). A number of the March 1980 documents were published in loose-leaf notebooks and have been issued to selected routine users on a numbered basis. These registered copies will be updated automatically as changes in the data base documentation are implemented. This procedure ensures that routine users of the FPEIS will have access to current documentation. Other users will receive updates through a quarterly publication, the first of which will be issued in the summer of 1980.

1.4 FPEIS TECHNOLOGY TRANSFER

The FPEIS brochure, which has been an effective means of introducing the FPEIS to the public, was updated in May 1979. The introductory brochure was prepared for distribution at the Air Pollution Control Association Annual Meeting in Cincinnati, Ohio, in June 1979 and at numerous other meetings and symposia. A technical paper on the FPEIS was presented to the APCA Annual Meeting in Cincinnati, Ohio which summarized recent additions and changes to the FPEIS.

Several EADS user symposia and training seminars were conducted this year for EPA contractors and for other organizations considering using the FPEIS. The 2-day symposia outlined the purpose of the data base, how to use it, data base structure and organization, and encoding instructions for the EADS multimedia waste stream data bases. In the training seminars, an FPEIS case study of a coal-fired utility boiler was used as an example for encoding practice. Symposia were held in Research Triangle Park, North Carolina in August; and in Long Beach, California; Palo Alto, California; and Cincinnati, Ohio; all in October 1979. The people who attended the symposia represented a wide variety of interests, including EPA personnel and private industry.

TABLE 1.2. FPEIS DATA ELEMENTS AND THEIR ORGANIZATIONAL LEVELS

Test Series Level	Effluent Stream Design Level	Test Operating Level	Sample Level
A. Source Description	C. Stream Characteristics (Design)	E. Test Identification	H. Sampling Activity Description
Source category	Flow rate and units	Date	Measurement instrument/method number
Source type	Velocity	Start and end times	Start time and duration
Product/device type	Temperature	Operating mode	Measured stream:
SIC code	Pressure	Percent design capacity	Flow rate
Process type	Moisture	Device operating parameters	Velocity
Design process rate and units	Stack height	Comments	Temperature
Feed material category	Stream name		Pressure
Source name	Comments	F. Fuels and Feedstocks	Moisture
Site name and address			Density determination
GEDS, and LEDS TSN's	D. Control Device or Treatment Storage/Recovery Process	Source feed material and units and rate	Sample volume
Series start and finish dates		Sample mass and units	Flow rate and units
Sponsor organization	Generic device/process type	Laboratory name and approval	Flow rate measurement method
Contract number	Design type	Feed sample volume and units	Sample mass and units
TO/TD number	Specific process/device type	Proximate analysis	Sampling location description
Name of sampling group/contractor	Device/process class	Ultimate analysis	Collection surface/substrate
Reference title, author, number publication date, and NTIS number	Commercial name	Physical characteristics	Comments
	Manufacturer	Inorganic and organic analysis	K. Component of Sampling Measurement Method
B. Test Series Comments	Device/process keywords	Comments characteristics	Component name
	Design parameters analysis		Chemical analysis laboratory name
			Chemical lab approval
			Radionuclide lab approval
			Component aliquot mass/volume and units
			Effluent characteristics
			Parameter
			Value and units
			Analysis method
			Detection limits
			L. Inorganic Analysis/non-Level Organic Analysis
			Species
			Analysis method
			Detection limits
			Concentration
			Comments

(continued)

TABLE 1.2. (continued)

Test Series Level	Effluent Stream Design Level	Test Operating Level	Sample Level
			M. Level Organic Analysis Fraction ID TCO Grav Species Analysis method Detection limits Concentration Comments
			R. Radionuclide Data Radionuclide ID Analytical method Detection limits Concentration Comments
			T. Bioassay Data Test type Test name Duration Laboratory sample ID Laboratory name and approval Test start and end dates Sample quantity and units Test organism/strains Type of value, value, and units Confidence limits Maximum applicable dose and units Level of toxicity Bacteria mutagenicity response Minimum effective concentration and units Approximate concentration factor Comments

SECTION 2.0

DATA BASE MODIFICATIONS

In 1978, only minor modifications of the FPEIS data base were implemented; for the most part, these changes were designed to increase its usability. The data base structure and the organization of the data within that structure were not affected. In 1979, however, major restructuring and redefining of the FPEIS data base were undertaken. Such a complete overhaul of FPEIS had not been anticipated and was not the result of any flaw in the system. On the contrary, the need to restructure FPEIS was due in large part to its success.

The most fundamental modification in the FPEIS was the organization of the data into four structural levels instead of three. The concept of test series, subseries, and run levels, as used in the FPEIS until 1979, is fully explained in the User Guide (4). Organization of data within these levels was more than sufficient for fine particle emissions studies, but such a structure put undesired restrictions on the handling of solid waste, gaseous emissions, or liquid effluent data. So, a more flexible four-level structure was adopted: the test series level; the stream design level; the test operating level; and the sample level.

The main difference between the restructured FPEIS and the old FPEIS is that the data on control device characteristics are no longer at the test series level. Instead, the stream design and test operating levels replace the old subseries level, and the control device characteristics have been moved to the stream design level. This move of the control device data to a lower level gives the new FPEIS its increased flexibility, since now one test series can include data taken on many effluent streams with many different control devices. Under the old structure, multiple test series would have had to be defined for one source if more than one effluent stream with different control devices were monitored. With the restructured FPEIS, the source, not the effluent stream or the control devices, determines the designation of a new test series.

The shift of the control device data to a lower level is not the only organizational change. The test data that were considered appropriate for the subseries level in the old FPEIS are now divided among stream design, test operating, and sample levels, while the data which were reported at the run

level are now entered at the sample level. In addition, data taken under the EPA Level 1 Environmental Assessment protocol are now more easily handled by the data base.

Figure 2.1 shows in a general way how data element groupings in the old data base have been accounted for in the restructured FPEIS. A more detailed discussion of the shifting and redefining of the FPEIS data elements follows.

As shown in Figure 2.1, data group A, Source Characteristics, which was formerly at the test series level, is data group A, Source Description, at the new test series level. Not just the name of the data group changed, however. The Source Classification Codes (SCC) are no longer used to characterize the source. Instead, more usable standard nomenclature has been adopted with the result that the coding of data should be much easier and more uniform. Along with the change in the use of standard nomenclature, several of the data elements were modified. Table 2.1 shows the new data elements of data group A, Source Description. For each new data element listed, the old data elements, if any, are given.

As can be seen from Table 2.1, the new data elements offer a more complete description of the source and how the data were gathered. Two elements in the old data base were dropped. Operating mode class (SCC IV) was no longer useful in characterizing the source, while UTM zone location and coordinates were seldom entered by users and thus were deemed no longer important. Regarding UTM, the nature of the R&D mission places far greater emphasize emissions from generic process sources than on the location of a specific process. That is to say, R&D has a broader scope in mind by looking at industry as a whole rather than individual sites.

Data group B, Test Series Remarks, remains unchanged at the test series level.

As mentioned, the data elements used to describe the control device characteristics were moved in the new FPEIS from the test series level to the effluent stream design level. Table 2.2 shows the data elements belonging to the new data group D, with the corresponding old elements.

As is shown in Figure 2.1, some of the data elements originally belonging to data group D, Test Characteristics, at the subseries level were moved to data group C, Stream Characteristics, at the effluent stream design level. Table 2.3 lists those data elements belonging to the new data group C, with the corresponding old elements.

Most of the remaining data elements of the old group D have been put into data group E, Test Identification, at the test operating level. Table 2.4 lists the data elements belonging to data group E and the corresponding old data elements, if any.

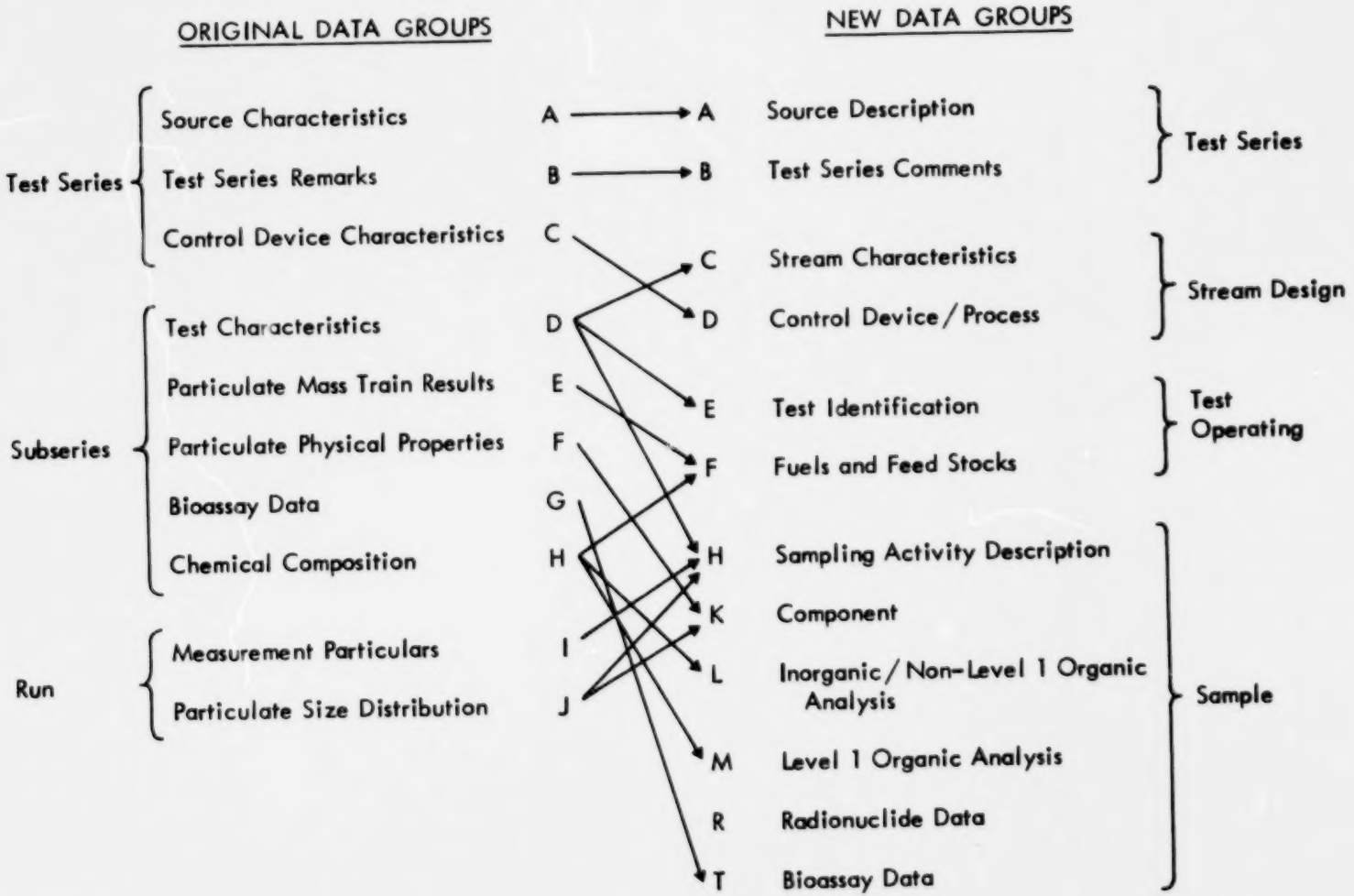

Figure 2.1. Relationships between data groups of the old and new FPEIS.

TABLE 2.1. NEW OR REDEFINED ELEMENTS OF GROUP A - SOURCE DESCRIPTION

EADS/FPEIS elements	Original FPEIS elements
Source category	Source category
Source type	Type of operation
Product/device type	
Process type	
Design process rate and units	
Feed material category	Feed material class
Source name	Source name
Site name and address	Site name, source address
Series start and finish dates	Test series start and finish dates
Sponsor organization	
Contract number	
TO/TD number	
Name of sampling group	Tested by
Reference title, author, number, publication date, NTIS number	Reference

TABLE 2.2. NEW OR REDEFINED ELEMENTS OF GROUP D - CONTROL DEVICE/TREATMENT PROCESS

EADS/FPEIS elements	Original FPEIS element
Generic device/process type	Generic device type
Design type	
Specific process/device type	
Device/process class	Device class and category
Commercial name	Device commercial name
Manufacturer	Manufacturer
Device/process keywords	Description
Design parameters	Design parameter type and value

TABLE 2.3. NEW OR REDEFINED ELEMENTS OF GROUP C - STREAM CHARACTERISTICS

EADS/FPEIS elements	Original FPEIS element
Flow rate and units	Volume flow rate
Velocity	Velocity
Temperature	Temperature
Pressure	Pressure
Moisture	Moisture content
Stack height	
Stream name	Sampling location and its description
Comments	Subseries remarks

TABLE 2.4. NEW OR REDEFINED ELEMENTS OF GROUP E - TEST IDENTIFICATION

EADS/FPEIS elements	Original FPEIS element
Date	Test date
Start and end times	Start and finish time
Operating mode	Source operating mode
Percent design capacity	Percent design capacity
Operating parameters	Source operating rate

The original FPEIS data base contained only a few data elements related to feed material and its chemical and physical properties, including feed material and its composition, front half and total mass concentration, resistivity, chemical entry code, chemical analysis method and ID, concentration in filter/total, and concentration in ranges 1 through 8. These elements were contained in data groups D, E, F, and H at the subseries level. The new FPEIS contains these data elements, along with many more. For example, Table 2.5 lists the data elements belonging to F, Fuels and Feedstocks, at the test operating level. Almost all of these data elements are new and contain more information than the old FPEIS could handle.

More chemical and physical properties are contained in data groups K, Component, and L, Inorganic Analysis/Nonlevel 1 Organic Analysis. Table 2-6 lists the data elements belonging to data group K, and Table 2.7 lists the data elements of data group L. Both data groups belong to the sample level of the new FPEIS and contain virtually all new data elements.

Three new data groups have been added to the sample level of FPEIS. Data group M includes data elements related to the EPA Level 1 Organic Analysis protocol, and data group R contains radionuclide information. These data elements are shown in Tables 2.8 and 2.9, respectively. The old FPEIS contained a data group G at the subseries level, which was to contain bioassay information but which never had data elements defined. The new FPEIS contains newly defined data elements related to bioassay information in data group T. These elements are listed in Table 2.10.

Most of the data elements belonging to data groups I, Measurement Particulars, and J, Particulate Size Distribution, of the run level in the old FPEIS have been moved to data group H of the sample level in the new FPEIS. In addition, four elements which had been located at the old subseries level--percent isokinetic sampling, density, density determination, and gas analysis and trace gas composition--are also now found in data group H of the data base. Table 2.11 lists the data elements which made up this data group.

As discussed, the new FPEIS data base is more comprehenisve in its description of the source and the control and measurement devices and techniques, and in its handling of the data from the various possible physical and chemical analyses. It is more flexible because it is now source-specific and no longer requires a new test series for each new stream from the same source. The new EADS/FPEIS is expected to be even more valuable to the user community than its predecessor because, with its new structure, it is compatible with the other data bases which now make up the EADS.

TABLE 2.5. NEW ELEMENTS OF GROUP F - FUELS AND FEEDSTOCKS

EADS/FPEIS elements	Original FPEIS element
Source feed material and rate	
Sample mass and units	
Laboratory name and approval	
Feed sample volume and units	
Proximate analysis	
Ultimate analysis	
Inorganic and organic analysis	
Physical parameters	
Comments	

TABLE 2.6. NEW ELEMENTS OF GROUP K - COMPONENT

EADS/FPEIS elements	Original FPEIS element
Component name	
Stage/filter cut size	
Mass/No. concentration	
Chemical analysis laboratory name	
Chemical laboratory approval	
Radionuclide laboratory approval	
Component mass/volume	
Effluent characteristics	
Parameter	
Value and units	
Analysis method	
Detection limits	
Comments	

TABLE 2.7. NEW ELEMENTS OF GROUP L - INORGANIC ANALYSIS/ NONLEVEL 1 ORGANIC ANALYSIS

EADS/FPEIS elements	Original FPEIS element
Species I.D.	
Analysis method	
Detection limits	
Concentration	
Comments	

TABLE 2.8 NEW ELEMENTS OF GROUP M - LEVEL 1 ORGANIC ANALYSIS

EADS/FPEIS elements	Original FPEIS element
Fraction ID	
TCO	
Grav	
Species I.D.	
Analysis method	
Detection limits	
Concentration	
Comments	

TABLE 2.9 NEW ELEMENTS OF GROUP R - RADIONUCLIDE DATA

EADS/FPEIS elements	Original FPEIS element
Radionuclide ID	
Analytical Method	
Detection Limit	
Concentration	
Comments	

TABLE 2.10. NEW ELEMENTS OF GROUP T - BIOASSAY DATA

EADS/FPEIS elements	Original FPEIS element
Test type	
Test name	
Duration	
Sample number	
Laboratory name and approval	
Test start and end dates	
Sample quantity and units	
Test organism/strains	
Type of value, value, and units	
Confidence limits	
Maximum applicable dose and units	
Level of toxicity	
Bacteria mutagenicity response and units	
Approximate concentration factor	
Comments	

TABLE 2.11. NEW OR REDEFINED ELEMENTS OF GROUP H - SAMPLING ACTIVITY DESCRIPTION

EADS/FPEIS elements	Original FPEIS elements
Measurement instrument/method name	Measurement instrument/method name
Start time and duration	Measurement start time and period
Measured stream	
Flow rate	Sample flow rate
Velocity	
Temperature	Temperature
Pressure	Pressure
Moisture	Moisture content
Density	Density
Density determination	Density determination
Sample volume	
Flow rate measurement method	
Sample mass and units	
Sampling location description	
Percentage isokinetic	Percent isokinetic sampling
CO_2, O_2, CO, N_2	Gas analysis
Dilution factor	Dilution factor
Particle diameter basis	Particle diameter basis
Particulate concentration basis	Concentration basis
Upper diameter boundary	Upper boundary
Trace gases	Trace gas composition
Collection surface/substrate comments	Comments

SECTION 3.0

1979 DATA ADDITIONS

The FPEIS data base continued growing in 1979; 46 new test series were added to the 120 already contained in the system, a 38% increase. The number of individual test measurements or runs increased; 914 runs were added to the original 1,907 runs, representing an increase of 48%. The data additions listed throughout this section pertain to test data submitted for permanent entry to FPEIS in 1979. The frequency of occurrence is given for each value.

The number of test series or runs and the data sources indicate that energy systems source testing was the predominant source of data added to FPEIS in 1979. This is shown in Table 3.1 and 3.2, the Source Category and Type of Operation data base entries for 1979. Of the new entries, electricity generation represented the most frequent operation. The 1979 data acquisitions also included 12 Feed Material Class entries, and 15 Operating Mode Class additions. These new entries are shown in Table 3.3 and 3.4, respectively.

Table 3.5 shows that the particulate control equipment data entries were mostly concerned with conventional control devices (mechanical collectors, fabric filters, scrubbers, and electrostatic precipitators (ESPs)); however, several experimental devices were reported. The new entries for Control Device Category and Control Device Commercial Name are listed in Tables 3.6 and 3.7, respectively. The variety of control device information entered in FPEIS in 1979 indicates there are no obvious trends in the types of control equipment applied to specific types of fine particle emission sources.

Table 3.8 lists the 14 Measurement Instrument/Method Names that were among the data acquired last year. The variety of instruments listed does not reflect the 622% increase in the amount of chemical data added to FPEIS primarily due to the extensive analytical results reported in EPA EA Level 1 testing performed with SASS train sampling systems. The amount of chemical data grew tremendously. As shown in Table 3.9, 1,580 chemical species were reported with information on 42 new and different chemical species.

TABLE 3.1. SOURCE CATEGORY - 1979 ENTRIES

FREQUENCY	VALUE
32	EXTCOMB BOILER
14	INDUSTRIAL BOILER
46	TOTAL OCCURRENCES

TABLE 3.2. TYPE OF OPERATION - 1979 ENTRIES

FREQUENCY	VALUE
2	COMMERCL-INSTUTNL
20	ELECTRIC GENERATN
7	FOOD/AGRICULTURAL
10	INDUSTRIAL
1	MINERAL PRODUCTS
6	PRIMARY METALS
46	TOTAL OCCURRENCES

TABLE 3.3. FEED MATERIAL CLASS - 1979 ENTRIES

FREQUENCY	VALUE
2	AL ORE-ELECROREDN
1	ASPHALT ROOFING
1	BARK/OIL
8	BITUMINOUS COAL
1	COKE-MET BYPRODUC
2	COPPER SMELTER
7	GRAIN PROCESSING
3	LIGNITE
13	OTHER/NOT CLASIFD
5	RESIDUAL OIL
1	STEEL PRODUCTION
1	WOOD
45	TOTAL OCCURRENCES

TABLE 3.4 OPERATING MODE CLASS - 1979 ENTRIES

FREQUENCY	VALUE
1	ELECT ARC W/LANCE
1	HOG FUEL BOILER
1	HORIZSTD SODERBURG
1	KRAFTRECOVERY
10	NA
7	OTHER/NOT CLASIFD
1	OVEN PUSHING
3	SPECIFY IN REMARKS
3	WOOD WASTE BOILER
1	>100MM BTU CYCLONE
1	>100MM BTU
5	>100MM BTU PULVDRY
7	>100MM BTU/HR
1	10-100 MM PVL WT.TON
1	10-100MMBTUSPDSTK
44	TOTAL OCCURRENCES

TABLE 3.5. CONTROL DEVICE CLASS - 1979 ENTRIES

FREQUENCY	VALUE
27	CONVENTIONAL
2	NA
1	NONE
1	NOVEL
6	PILOT SCALE
1	PROTOTYPE
38	TOTAL OCCURRENCES

TABLE 3.6. CONTROL DEVICE CATEGORY - 1979 ENTRIES

FREQUENCY	VALUE
2	COMBINATION
2	DOUBLE CHAMBER ESP
1	DRY, COLDSIDE, PARALLEL PLATE
1	FABRIC FILTER
2	HI VOLTAGE
2	HI VOLTAGE ESP
1	HOT
1	HOTSIDE
1	MECHANICAL SHAKE
3	MULTIPLE
15	NA
1	NONE
1	OTHER
1	PLATE
1	PLATE ESP
1	SINGLE
3	VENTURI VARIABLE THROAT
39	TOTAL OCCURRENCES

TABLE 3.7. CONTROL DEVICE COMMERCIAL NAME - 1979 ENTRIES

FREQUENCY	VALUE
1	DACRON TM FILTER TUBES
2	DUAL THROAT VENTURI SCRUBBER
1	ELECTRIFIED BED (EFB)
3	ELECTROSTATIC PRECIPITATOR
1	EPA MOBILE ESP
2	ESP
1	MOBILE ESP
1	MOBILE FABRIC FILTER SYSTEM
1	MODEL 6700 TCAS
2	MULTICLONE
2	MULTICLONE 9DG12
13	NA
1	NONE
1	VENTURI SCRUBBER
33	TOTAL OCCURRENCES

TABLE 3.8. MEASUREMENT INSTRUMENT/METHOD NAME - 1979 ENTRIES

FREQUENCY	VALUE
42	ANDERSEN MODEL II IMPACTOR
98	ANDERSEN MODEL III IMPACTOR
158	BAUSCH AND LOMB MODEL 40-1-OPC
127	BRINK BMS-11 IMPACTOR
19	MRI MODEL 1502 IMPACTOR
14	OTHER
151	OTHER IMPACTOR
5	OTHER - OPC
150	RICH 100 CNC
44	SASS TRAIN - WITH CYCLONES
7	SIERRA C-226 IMPACTOR
87	UW MARK III IMPACTOR
6	WHITBY ELEC. ANALYZER MOD 3030
6	WIRE SCREEN DIFF BATTERY
914	TOTAL OCCURRENCES

TABLE 3.9. CHEMICAL SPECIES - 1979 ENTRIES

FREQUENCY	CHEMICAL SPECIES	FREQUENCY	CHEMICAL SPECIES
40	ALUMINUM	11	LANTHANUM
17	ANTIMONY	3	NIOBIUM
40	ARSENIC	3	OSMIUM
9	BERYLLIUM	3	PALLADIUM
21	BARIUM	16	PHOSPHORUS
7	BORON	5	PLATINUM METAL
23	BROMINE	22	SELENIUM
9	CADMIUM	3	PRASEODYMIUM
39	CALCIUM	3	RHENIUM
51	CHROMIUM	3	RHODIUM
41	COBALT	3	TIN
46	COPPER	56	TITANIUM
19	CHLORINE	11	SAMARIUM
11	CERIUM	8	SCANDIUM
11	CESIUM	26	SILICON
3	DYPROSIUM	51	ZINC
3	ERBIUM	8	TANTALUM
11	EUROPIUM	3	TELLURIUM
3	GADOLINIUM	8	TERBIUM
11	GALLIUM	3	THALLIUM
3	GERMANIUM	11	THORIUM
63	IRON	3	THULIUM
11	HAFNIUM	7	RUBIDIUM
43	LEAD	3	RUTHENIUM
3	HOLMIUM	9	TUNGSTEN
8	INDIUM	9	URANIUM
51	MANGANESE	34	POTASSIUM
3	IRIDIUM	11	YTTERSBIUM
12	MOLYBDENUM	3	YTTRIUM
43	NICKEL	23	SODIUM
15	LITHIUM	10	ZIRCONIUM
8	LUTETIUM	5	FLUORIDE ION
48	MAGNESIUM	2	SULFATE
11	IODINE	12	SULFITE
18	MERCURY	2	STRONTIUM
8	GOLD	25	VANADIUM
9	NEODYMIUM		

1,580 TOTAL OCCURRENCES

SECTION 4.0

FPEIS DATA BASE SUMMARY

The FPEIS has evolved into the most comprehenisve and authoritative source of stationary source particle sizing emissions data available today. As of December 31, 1979, the FPEIS data base contained information on 165 test activities (test series) and 2,821 individual test measurements (test runs). The amount of information the FPEIS now includes on sources, control devices, sampling and analysis methods, and particulate and chemical analyses is of sufficient variety for the FPEIS data base to be a valuable resource for fine particle technology research. As an example of the variety in the FPEIS, there are 6 specific Source Categories and 17 Types of Operation, as listed in Tables 4.1 and 4.2, respectively. Thirty-six different Feed Material Classes and 46 Operating Mode Classes are reported in FPEIS. These are given in Table 4.3 and 4.4, respectively. Information on many control devices is stored in the FPEIS; for instance, data on several Control Device Clases, 47 Control Device Categories, and 45 Control Device Commercial Names, as shown in Tables 4.5, 4.6, and 4.7, respectively. In addition, 26 different Measurement/Methods are included in the FPEIS as shown in Table 4.8. Information on 77 different chemical species can be found in the FPEIS, and they are listed in Table 4.9.

A summary of the contents of the FPEIS data base as of December 31, 1979, is provided in the Appendix. As new test data are added to the FPEIS, the data base will be updated.

The prime objective of the FPEIS from its inception was to provide a current and accurate emissions data base. Since it is now a requirement for EPA IERL/ RTP contractors performing fine particle emissions testing to submit their data findings to the FPEIS, the growth of the FPEIS is expected to continue at a steady rate.

TABLE 4.1. SUMMARY OF SOURCE CATEGORY

FREQUENCY	VALUE
99	EXTCOMB BOILER
61	INDUSTRIAL PROCESS
1	INTERNLCOMBUSTION
1	LABORATORY
2	OTHER
2	SOLID WASTE
175	TOTAL OCCURRENCES

TABLE 4.2. SUMMARY OF TYPE OF OPERATION

FREQUENCY	VALUE
3	CHEMICAL MFG
3	COMMERCL-INSTUTNL
1	DEVICE EVALUATION
62	ELECTRIC GENERATN
8	FOOD/AGRICULTURAL
2	GOVERNMENT
34	INDUSTRIAL
1	LAB ANALYSIS
14	MINERAL PRODUCTS
1	PETROLEUM INDRY
22	PRIMARY METALS
1	PROTOTYPE TEST
7	SECONDARY METALS
6	WOOD PRODUCTS
165	TOTAL OCCURRENCES

TABLE 4.3. SUMMARY OF FEED MATERIAL CLASS

FREQUENCY	VALUE
3	AL ORE-ELECROREDN
1	ANTHRACITE COAL
1	ASPHALT BATCHING
2	ASPHALT ROOFING
1	BARK/OIL
19	BITUMINOUS COAL
1	CEMENT MFG DRY
1	CEMENT MFG WET
1	CERAMIC/CLAY MFG
1	COAL
1	COKE
2	COKE-MET BYPRODUC
6	COPPER SMELTER
1	COTTON GINNING
1	DIESEL FUEL
1	DISTILLATE OIL
1	FERTILIZER-UREA
7	GRAIN PROCESSING
4	GRAY IRON
1	INCINERATOR
2	LEAD SMELTERS
3	LIGNITE COAL
1	MINERAL WOOL
37	OTHER/NOT CLASIFD
1	PHOS-ACID THERMAL
1	POTASSIUM CHLORID
1	PROCESS HEATER
1	PULP/PAPER MILL
16	RESIDUAL OIL
2	SALT MINING
6	SOLID WASTE/COAL
2	STEEL FOUNDRY
5	STEEL PRODUCTION
6	SULFATE PULPING
3	WOOD
4	ZINC SMELTING
147	TOTAL OCCURRENCES

TABLE 4.4. SUMMARY OF OPERATING MODE CLASS

FREQUENCY	VALUE
1	BATTERY CONDENSER
1	BLAST FURNACE
1	CALCINATION
2	CONVERTING
5	CUPOLA
2	DRYING
1	DUST FEEDER
1	ELECT ARC W/LANCE
1	ELECTRIC ARC NOLANCE
1	GAS
1	HOG FUEL BOILER
1	HORIZSTD SODERBURG
1	KILNS
3	KILNS-GAS FIRED
1	KRAFTRECOVERY
4	LIME KILNS
19	NA
2	OPENHEARTH OXLANCE
1	OPNHEARTH OXLANCE
2	OTHER/NOT CLASIFD
1	OVEN CHARGING
1	OVEN PUSHING
1	PRILLING TOWER
2	PULVERIZED COAL
1	RECIPROCATING
2	RECVY BOLR/OCEVAP
1	ROASTING
1	ROASTING/REVERBERATI
2	ROTARY DRYER
1	ROTARY SALT DRYER
1	SALT DRYERS/MILLS
1	SELF-BAKING
2	SINTERING
1	SMELTING
9	SPECIFY IN REMARKS
6	STOKER
2	VERT RETORTS
5	WOOD WASTE BOILER
6	>100MM BTU PULVERIZED
1	>100MM BTU CYCLONE
8	>100MM BTU PULVDRY
22	>100MM BTU/HR
1	10-100 MM PVL WT.TON
1	10-100 MM BTU SPDSTK
7	10-100 MM BTU/HR
1	10-100 MM BTU/HR STKR
138	TOTAL OCCURRENCES

TABLE 4.5. SUMMARY OF CONTROL DEVICE CLASS

FREQUENCY	VALUE
106	CONVENTIONAL
1	CYCLONE
4	NA
2	NONE
19	NOVEL
15	PILOT SCALE
6	PROTOTYPE
153	TOTAL OCCURRENCES

TABLE 4.6. SUMMARY OF CONTROL DEVICE CATEGORY

FREQUENCY	VALUE
2	CENTRIFUGAL
1	COLDSIDE
3	COMBINATION
4	CONTINUOUSLY CLEANED REVERSE AIR
2	DOUBLE CHAMBER ESP
1	DRY
1	DRY COLDSIDE HI-VOLTAGE
1	DRY HOTSIDE PLATE DOUBLE CHAMBER
1	DRY, COLDSIDE, PARALLEL PLATE
1	DRY, COLDSIDE, PLATE, DOUBLE CHAMBER
2	DRY, COLDSIDE, PLATE, HI-VOLT, 2 CHAM
1	DRY, COLDSIDE, PLATE, SINGLE CHAMBER
3	ESP
1	ESP-DRY
1	FABRIC FILTER
2	FIBROUS PACKING
4	GAS ATOMIZED SPRAY
2	HI VOLTAGE
2	HI VOLTAGE ESP
1	HOT
2	HOTSIDE
1	HOTSIDE, DRY, PLATE
1	IMPINGEMENT
1	IMPINGMENT PLATE
1	INTERMITTENTLY CLEANED
1	MECHANICAL COLLECTOR
4	MECHANICAL SHAKE
3	MOVING BED
8	MULTIPLE
3	MULTIPLE CYCLONE
1	MULTI-VENTURI FLEXITRAY
17	NA
2	NONE
12	OTHER
1	PIPE
14	PLATE
1	PLATE ESP
4	PREFORMED SPRAY
1	PREFORMED SPRAY WET SCRUBBER
8	REVERSE AIR
2	SINGLE
1	VENTURI
1	VENTURI SCRUBBER
5	VENTURI VARIABLE THROAT
3	WET
1	WET HOTSIDE
2	WET HOTSIDE LOW VOLTAGE
137	TOTAL OCCURRENCES

TABLE 4.7. SUMMARY OF CONTROL DEVICE COMMERCIAL NAME

FREQUENCY	VALUE
1	AERONETICS TWO-PHASE JET SCRUB
2	AFTERBURNER
7	BAGHOUSE
5	BAGHOUSE (PILOT UNIT)
1	BRAXTON SONIC AGGLOMERATOR
1	CENTRIFIELD SCRUBBER
1	CLNB HI EFFCY AIR FLTR (CHEAF)
5	CONFIDENTIAL
2	COTRELL PRECIPITATOR TYPE RSP
2	CYCLONE
1	DACRON TM FILTER TUBES
2	DUAL THROAT VENTURI SCRUBBER
1	DUST COLLECTOR
1	DYNACTOR SCRUBBER
1	ELECTRIFIED BED (EFB)
7	ELECTROSTATIC PRECIPITATOR
1	EPA MOBILE ESP
21	ESP
1	GRAVEL BED FILTER
1	IMPINJET WET SCRUBBER
1	KINPACTOR 10X56 VNTURI SCRUBBR
1	KOCH FLEXITRAY
1	LONE-STAR STEEL STEAM-HYDRO
1	MGOX SCRUBBER
10	MOBILE BAGHOUSE
1	MOBILE ESP
1	MOBILE FABRIC FILTER SYSTEM
1	MODEL 6700 TCAS
5	MULTICLONE
2	MULTICLONE 9DG12
1	MULTIVANESCRUBBER
23	NA
2	NONE
1	PENTAPURE SCRUBBER
1	SECONDARY COLD CYCLONE
1	SPRAY TOWER
1	TCA
3	THER-O-FLEX FILTERS
1	TURBULENT CONTACT ABSORBER, TCA
1	TURBULENT CONTACT ABSORBER
1	VENTURI
4	VENTURI SCRUBBER
2	VENTURI-ROD SCRUBBER
2	WET SCRUBBER
1	WETTED FIBER SCRUBBER
143	TOTAL OCCURRENCES

TABLE 4.8. SUMMARY OF MEASUREMENT/INSTRUMENT NAME

FREQUENCY	VALUE
192	ANDERSEN IMPACTOR
50	ANDERSEN MODEL II IMPACTOR
678	ANDERSEN MODEL III IMPACTOR
35	ANDERSEN MODEL IV IMPACTOR
166	BAUSCH AND LOMB MODEL 40-1-OPC
20	BRINK BMS-III IMPACTOR
448	BRINK BMS-11 IMPACTOR
43	BRINK BMS-11 MODIFIED
170	BRINK IMPACTOR
21	BRINK MODEL B IMPACTOR
4	CLIMET MODEL-OPC
18	CNC/DIFF BATTERY
2	ELECTRICAL ANALYZER TS M-3030
111	MRI MODEL 1502 IMPACTOR
58	OTHER
208	OTHER IMPACTOR
18	OTHER-CNC
53	OTHER-OPC
190	RICH 100-CNC
1	ROYCO MODEL OPC
4	ROYCO MODEL-OPC-225
3	SASS TRAIN
7	SIERRA C-226 IMPACTOR
280	UW MARK III IMPACTOR
12	WHITBY ELECTRICAL ANALYZER 3030
29	WIRE SCREEN DIFF BATTERY
2,821	TOTAL OCCURRENCES

TABLE 4.9. SUMMARY OF CHEMICAL SPECIES

FREQUENCY	CHEMICAL SPECIES	FREQUENCY	CHEMICAL SPECIES
8	POLYNUCLEAR HYDROCARBONS	8	LANTHANUM
51	ALUMINUM	11	NEODYMIUM
28	ANTIMONY	11	LANTHANUM
54	ARSENIC	3	NIOBIUM
18	BERYLLIUM	3	OSMIUM
33	BARIUM	3	PALLADIUM
7	BORON	27	PHOSPHORUS
23	BROMINE	5	PLATINUM METAL
46	CADMIUM	33	SELENIUM
65	CALCIUM	3	PRASEODYMIUM
76	CHROMIUM	3	RHENIUM
62	COBALT	3	RHODIUM
66	COPPER	12	TIN
19	CHLORINE	78	TITANIUM
14	CARBON	11	SAMARIUM
11	CERIUM	8	SCANDIUM
11	CESIUM	37	SILICON
3	DYPROSIUM	83	ZINC
3	ERBIUM	8	TANTALUM
11	EUROPIUM	12	TELLURIUM
3	GADOLINIUM	8	TERBIUM
11	GALLIUM	5	THALLIUM
3	GERMANIUM	11	THORIUM
98	IRON	3	THULIUM
11	HAFNIUM	7	RUBIDIUM
81	LEAD	3	RUTHENIUM
3	HOLMIUM	9	TUNGSTEN
8	INDIUM	9	URANIUM
66	MANGANESE	45	POTASSIUM
3	IRIDIUM	11	YTTERBIUM
12	MOLYBDENUM	3	YTTRIUM
70	NICKEL	34	SODIUM
22	LITHIUM	10	ZIRCONIUM
8	LUTETIUM	19	FLUORIDE ION
65	MANGNESIUM	16	CHLORIDE
11	IODINE	12	PERCHLORATE
28	MERCURY	18	SULFATE
2	STRONTIUM	22	SULFITE
		25	VANADIUM

1,834 TOTAL OCCURRENCES

SECTION 5.0

PLANS FOR 1980

5.1 DATA ACQUISITION

It is expected that the FPEIS will maintain a steady growth record during 1980 in terms of the number of sites tested and the number of samples taken per site. Since June 1978, all new IERL/RTP projects which involve particle sampling have been required to encode and enter the results from those tests into the FPEIS data base. As these projects become active, data from them will be entered routinely into the data base. Additionally, in 1980 valuable data from the ongoing IERL/RTP Environmental Assessment sampling programs will be received for entry into the FPEIS.

Data acquisition is not expected to be limited to IERL/RTP testing programs. In support of an inhalable particulate (IP) standard development, the EPA's Office of Research and Development (OR&D) has undertaken a program to provide emission factors for inhalable particles. Revisions to the particulate standard reflect the need for new particle size data which will be provided to FPEIS from OR&D's IP sampling programs. It is expected that FPEIS will be utilized to aid OR&D personnel in setting priorities for IP sampling programs. In addition to IP data, source testing data from IERL/ Cincinnati will be submitted to the FPEIS.

Some carryover work from 1979 will provide a substantial quantity of fine particle sizing data collected by the State of California Air Resources Board. Data will be sought from environmental agencies in many other states.

Since the FPEIS has been restructured and reorganized, radionuclide and bioassay results are expected to be reported. The EPA's Office of Radiation Programs will provide for the FPEIS airborne radon and radioactive particulate emissions source testing data. The general purpose of the field test program is to gather background information pertaining to the quantities of naturally occurring radionuclides discharged to the environment from various mining operations. Plans to acquire these data in 1980 are being developed.

5.2 DATA BASE MODIFICATIONS

With the development and implementation of the EADS during 1979, the FPEIS underwent major revisions to render the fine particle data system

compatible with the other waste stream data systems. Since the FPEIS has been recently revised, most of the data base modifications will be minor and involve the addition of new data elements for which no data have been reported to date. A new data grouping is expected to be added detailing process stream operating conditions.

5.2.1 Process Stream Operating Characteristics

This data grouping will contain additional parameters relating to source process conditions, including the source operating mode and rate, as well as identification of the operating parameters and values. Typical process operating characteristics such as flow rate, temperature, pressure, etc., will be provided. These data will enable users to evaluate any effect process operating conditions may have on the fine particle emissions generated by the source.

5.3 FPEIS DATA RETROFIT

The task is to convert the existing data found in the old FPEIS format to the new EADS/FPEIS data organization. EADS software will be developed for the data conversion.

There will be several steps required to complete this retrofit. Initially, the data elements compatible with the new format must be identified and entered directly. Then, the incompatible data must be manually input into the new format. In most cases, the incompatible data cannot be directly submitted to the EADS/FPEIS format because of data input format differences. The last step in the data conversion will be to complete null data elements, most of which occur because certain data were not previously reported in FPEIS that are now included in the EADS/FPEIS. Most of these null data items are included in the old FPEIS but are now presented in much more detail in the EADS/FPEIS.

The FPEIS data retrofit procedure will probably begin with the most recent data acquisitions entered into the FPEIS and work backwards toward the early data. The lastest sets of data are expected to be determined with the more recent sampling and anlaysis state-of-the-art procedures and protocols. The prospect of procuring null data is anticipated to be greater with the later test series.

5.4 TECHNOLOGY TRANSFER

As the FPEIS grows in scope and use, the need to maintain a well-informed user community grows as well. The major revision of the FPEIS documentation (EADS/FPEIS User Guide, EADS Terminology Reference Manual, and EADS Systems Overview Manual) is scheduled for completion for the spring of 1980. Holders

of registered documentation will receive documentation changes and data updates automatically. Other users or interested parties will be notified by way of a quarterly update publication.

The first quarterly update issue has been scheduled for late summer or early fall of 1980. Each issue will describe changes or enhancements to the FPEIS since the previous one. Also, new data additions will be described and any new publications will be announced. It is hoped that these quarterly updates will provide a forum for comments and suggestions by the user community, as well as a means of informing the users of new developments.

Some special reports, brochures, etc., will be prepared as needed. A new FPEIS brochure will be prepared in the spring of 1980. As noted previously, the brochure has been a very effective means of introducing the FPEIS to the public.

5.5 NEW USER SOFTWARE

A cascade impactor data reduction system (CIDRS), originally developed by Southern Research Institute (12), has been adapted to perform particle size distribution calculations with data retrieved from the FPEIS data base. The CIDRS software, as shown in Figure 5.1, will be implemented by the summer of 1980. The overall system incorporates five programs: MPPROG, SPLIN1, STATIS, PENTRA, and GRAPH. CIDRS currently is designed to work only with cascade impactor data; however, it will be modified to include data from cyclones (SASS train).

Raw data on sampling conditions and impactor stage weights are entered into MPPROG to calculate the particle size distribution using the D_{50} analysis method. Those calculations are then stored in the FPEIS data base, as shown in Figure 5.1. Details on the data requirements can be found in the CIDRS manual by Southern Research Institute (13).

SPLIN1 is a curve fitting program used for plotting cumulative mass distributions. A special subroutine has been developed and incorporated into CIDRS that allows extrapolation of particle concentrations and sizes through the inhalable size range. STATIS average data from multiple impactor runs under common conditions and performs statistical computations. PENTRA calculates the control device fractional efficiency curve by selecting a pair (i.e., inlet and outlet) of individual impactor runs. The GRAPH program produces cumulative distribution graphs.

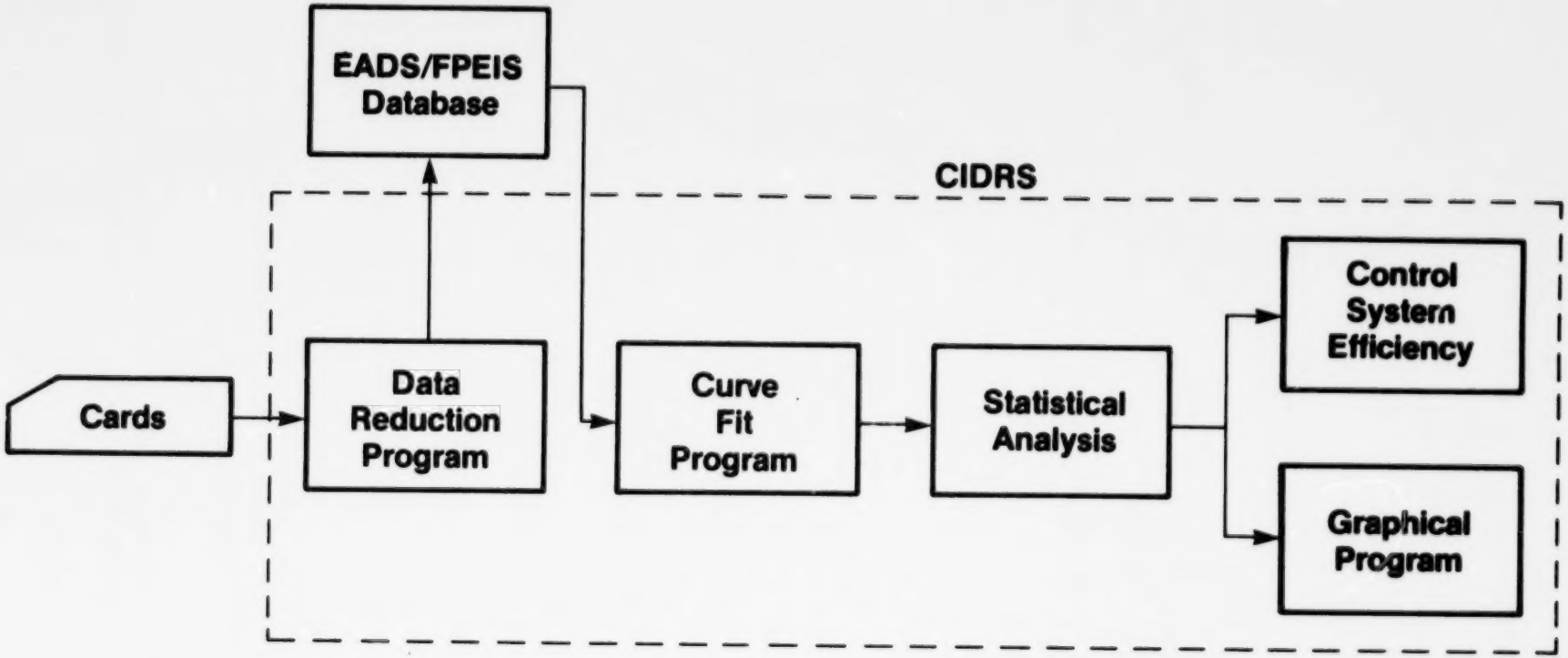

Figure 5.1. CIDRS software.

REFERENCES

1. Shannon, L. J., P. G. Gorman, and M. Reichel. Particulate Pollutant System Study, Volume II: Fine Particle Emissions. Midwest Research Institute, EPA No. APTD-0744, NTIS No. PB 203-521, August 1971.

2. Guiding for Compiling a Comprehensive Emission Inventory. EPA No. APTD-1135, NTIS No. PB 212-231, March 1973.

3. SOTDAT Final Report. EPA-450/3-75-070, NTIS No. PB 245-052, July 1975.

4. Schrag, M. P., Editor. Fine Particle Emissions Information System User Guide. Midwest Research Institute, EPA-600/8-78-006, NTIS No. PB 285-877, June 1978.

5. Schrag, M. P., Editor. Fine Particle Emissions Information System Reference Manual. Midwest Research Institute, EPA-600/8-78-007, NTIS No. PB 286-004, June 1978.

6. Reider, J. P., Editor. Environmental Assessment Data System User Guide: Fine Particle Emissions Information System. Midwest Research Institute, EPA-600/8-80-005, January 1980.

7. Larkin, R., Editor, Environmental Assessment Data System: System Overview Manual. EPA-600/8-80-011, February 1980.

8. Larkin, R. Editor, Environmental Assessment Data System: Terminology Reference Manual. EPA-600/8-80-011, February 1980.

9. Larkin, R., Editor. Environmental Assessment Data System User Guide: Gaseous Emissions Data System. EPA-600/8-80-006, January 1980.

10. Larkin, R., Editor. Environmental Assessment Data System User Guide: Liquid Effluents Data System. EPA-600/8-80-008, January 1980.

11. Larkin, R., Editor. Environmental Assessment Data System User Guide: Solid Discharge Data System. EPA-600/8-80-009, January 1980.

12. Johnson, J., et al. Extending Precision in a Computer-Based Cascade Impactor Data Reduction System in: W. B. Smith, Editor, Proceedings: Second Symposium on Advances in Particle Sampling and Measurement, Daytona Beach, Florida, October 1979. EPA-600/9-80-004, January 1980.

13. Johnson, J., et al. A Computer-Based Cascade Impactor Data Reduction System. EPA-600/7-78-042, March 1978.

APPENDIX

FPEIS DATA BASE SUMMARY
(as of December 31, 1979)

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
1	Harris, D. B., and D. C. Drehmel, "Fractional Efficiency of Metal Fume Control as Determined by Brink Impactor," EPA/CSL (1973)	Brink Model B Impactor	Zn Roaster	Wet ESP (Tube-and-Wire)	4
2	Harris, D. B., and D. C. Drehmel, "Fractional Efficiency of Metal Fume Control as Determined by Brink Impactor," EPA/CSL (1973)	Brink Model B Impactor	Cu Converter	Wet ESP (Tube-and-Wire)	4
3	Harris, D. B., and D. C. Drehmel, "Fractional Efficiency of Metal Fume Control as Determined by Brink Impactor," EPA/CSL (1973)	Brink Model B Impactor	Zn Sintering	Dry ESP (Rod-and-Wire)	2
4	Harris, D. B., and D. C. Drehmel, "Fractional Efficiency of Metal Fume Control as Determined by Brink Impactor," EPA/CSL (1973)	Brink Model B Impactor	Pb Sintering	Baghouse (Orlon) Mechanical Shake	2
5	Harris, D. B., and D. C. Drehmel, "Fractional Efficiency of Metal Fume Control as Determined by Brink Impactor," EPA/CSL (1973)	Brink Model B Impactor	Pb Blast Furnace	Baghouse (Wool felt) Mechanical Shake	2
6	Statnick, R. M., "Measurement of SO_2, Particulate, and Trace Elements in a Copper Smelter Converter and Roaster/ Reverberatory Gas Streams," EPA/CSL (1974)	Andersen Model III Impactor	Cu Roaster and Reverberatory Furnace	Dry ESP (pipe) and Parallel ESP (plate)	1
7	Statnick, R. M., "Measurement of SO_2, Particulate, and Trace Elements in a Copper Smelter Converter and Roaster/ Reverberatory Gas Streams," EPA/CSL (1974)	Andersen Model III Impactor Brink Model B Impactor	Cu Converter	Plate Type ESP	2

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
8	McCain, J. D., and W. B. Smith, "Lone Star Steel Steam-Hydro Air Cleaning System Evaluation," EPA-650/2-74-028 (1974)	Andersen Impactor Brink BMS-II Impactor CNC/Diffusion Battery Optical Particle Counter	Open Hearth Furnace	Lone Star Steel Steam-Hydro Scrubber (Novel Device)	38
9	Cooper, D. W., and D. P. Andersen, "Dynactor Scrubber Evaluation," GCA Corporation (1974)	Andersen Model III Impactor	Test Aerosol from Dust Feeder	Dynactor Scrubber (Novel Device)	50
10	Harris, D. B., "Tests Performed at Celotex Corporation, Goldsboro, North Carolina"	UW Mark III Impactor	Asphalt Roofing	Afterburner	1
11	Harris, D. B., and J. A. Turner, "Particulate and SO_2/SO_3 Measurement Around an Anthracite Steam Generator Baghouse," EPA/CSL (1973)	Brink BMS-II Impactor	Pulverized Coal-Fired Utility Boiler	Baghouse (Glass fiber) Reverse Air	4
12	McKenna, J. D., "Applying Fabric Filtration to Coal-Fired Industrial Boilers: A Preliminary Pilot Scale Investigation," Enviro-Systems and Research, Inc. (1974)	Andersen Impactor	Stoker-Fired Industrial Boilet	Baghouse (Pilot-scale) Reverse Air	3
13	Cowherd, C., et al., "Hazardous Emission Characterization of Utility Boilers," EPA-650/2-75-066 (1975)	Brink BMS-II Impactor	Pulverized Coal-Fired Utility Boiler	Conventional Cyclone	6
14	EPA Contract 68-02-2144, Test Location No. 19	SASS Train-With Cyclones	Residual Oil-Fired Industrial Boiler	None	4
15	Statnick, R. M., and D. C. Drehmel, "Fine Particulate Control Using SO_2 Scrubbers," EPA (1974)	Brink Impactor	Coal-Fired Utility Boiler	TCA Scrubber	14
16	Statnick, R. M., and D. C. Drehmel, "Fine Particulate Control Using SO_2 Scrubbers," EPA (1974)	Brink Impactor	Coal-Fired Utility Boiler	Venturi Scrubber	4

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
17	Statnick, R. M., and D. C. Drehmel, "Fine Particulate Control Using SO_2 Scrubbers," EPA (1975)	Andersen Model III Impactor Brink Impactor	Residual Oil-Fired Boiler	Venturi MgO Scrubber	8
18	Riggenbach, J. D., E. D. Johnson and M. K. Hamlin, "Measurement of Particulate Grain Loadings, Particle Size Distribution, and Sulfur Gas Concentrations at Hoerner Waldorf's Pulp and Papermill No. 3 Recovery System," Vols. I, II, and III, Environmental Science and Engineering, Inc. (1973)	Brink Impactor	Pulp and Papermill Recovery Boiler	ESP	39
19	Shannon, L. J. et al., "St. Louis/Union Electric Refuse Firing Demonstration Air Pollution Test Report" (1974)	Andersen Impactor Brink Impactor	Solid Waste/Coal-Fired Utility Boiler	ESP (plate)	26
20	McCain, J. D., "Evaluation of Aronetics Two-Phase Jet Scrubber," EPA-650/2-74-129 (1974)	Brink and Andersen Impactors CNC/Diffusion Battery Optical Particle Counter	Ferro-Alloy Submerged Arc Furnace	Aronetics Two-Phase Jet Scrubber (Novel Device)	41
21	Bosch, J. C., M. J. Pilat, and B. F. Hrutfiord, "Size Distribution of Aerosols From a Kraft Mill Recovery Furnace," Tappi 54(11):1871 (1971)	UW Mark III Impactor	Kraft Mill Recovery Furnace	ESP (plate)	4
22	McCarry, F. J., and C. J. Gregory, "A Comparison of the Size Distribution of Particulates Emitted from Air, Mechanical, and Steam Atomized Oil-Fired Burners," JAPCA, 22(8):636 (1972)	Andersen Impactor	Residual Oil-Fired Utility Boiler	ESP (plate)	1

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
23	McGarry, F. J., and C. J. Gregory, "A Comparison of the Size Distribution of Particulates Emitted from Air, Mechanical, and Steam Atomized Oil-Fired Burners," JAPCA, 22(8):636 (1972)	Andersen Impactor	Residual Oil-Fired Utility Boiler	ESP (plate)	1
24	McGarry, F. J., and C. J. Gregory, "A Comparison of the Size Distribution of Particulates Emitted from Air, Mechanical, and Steam Atomized Oil-Fired Burners," JAPCA, 22(8):636 (1972)	Andersen Impactor	Residual Oil-Fired Utility Boiler	ESP (plate)	1
25	Lee, R. E., Jr., H. L. Crist, A. E. Riley, and K. E. MacLeod, "Concentration and Size of Trace Metal Emissions from a Power Plant, a Steel Plant, and a Cotton Gin," Env. Sci. and Tech., 9(7):643 (1975)	UW Mark III Impactor	Utility Boiler	ESP (plate)	2
26	Lee, R. E., Jr., H. L. Crist, A. E. Riley, and K. E. MacLeod, "Concentration and Size of Trace Metal Emissions from a Power Plant, a Steel Plant, and a Cotton Gin," Env. Sci. and Tech., 9(7):643 (1975)	UW Mark III Impactor	Electric Arc Furnace	Baghouse (Mechanical Shake)	2
27	Lee, R. E., Jr., H. L. Crist, A. E. Riley, and K. E. MacLeod, "Concentration and Size of Trace Metal Emissions from a Power Plant, a Steel Plant, and a Cotton Gin," Env. Sci. and Tech., 9(7):643 (1975)	UW Mark III Impactor	Cotton Gin	Wet Scrubber	2
28	"St. Louis/Union Electric Refuse Fuel Project," MRI Project No. 3821-C(4), January 1975	Andersen Model III Impactor Brink Impactor CNC/Diffusion Battery Optical Particle Counter	Solid Waste/Coal-Fired Utility Boiler	ESP (plate)	67

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
29	"St. Louis/Union Electric Refuse Fuel Project," MRI Project No. 4033-C, Monthly Report No. 1 (1975)	Andersen Impactor Brink Impactor	Solid Waste/Coal-Fired Utility Boiler	ESP (plate)	12
30	"Test and Evaluation Program for St. Louis/Union Electric Refuse Fuel Project," MRI Project No. 4033-C, Monthly Report No. 4 (1975)	Andersen Impactor Brink Impactor CNC/Diffusion Battery Optical Particle Counter	Solid Waste/Coal-Fired Utility Boiler	ESP (plate)	43
31	"Test and Evaluation Program for St. Louis/Union Electric Refuse Fuel Project," MRI Project No. 4033-C, Monthly Report No. 11 (1976)	Andersen Model III Impactor Brink BMS-II Impactor	Solid Waste/Coal-Fired Utility Boiler	ESP (plate)	19
32	Toca, F. M., "Lead and Cadmium Distribution in the Particulate Effluent from a Coal-Fired Boiler," Ph.D. Thesis, University of Iowa, Ames, Iowa, (1972)	Andersen Impactor	Traveling-Grate Stoker Boiler	Cyclone	5
33	Baladi, E., "Particle Size Distribution Tests for Beker Industries Corporation," MRI Project No. 5-1379-C (1975)	Brink Model B Impactor	Phosphate Rock Calciner	Venturi Scrubber	5
34	Gooch, J. P., and J. D. McCain, "Particulate Collection Efficiency Measurements on a Wet Electrostatic Precipitator," EPA-650/2-75-033 (1975)	Andersen Impactor CNC/Diffusion Battery Optical Particle Counter	Aluminum Reduction Cells	Wet ESP (plate) Preceded by Wet Scrubbers	17
35	Bradway, R. M., and R. W. Cass "Fractional Efficiency of a Utility Boiler Baghouse," EPA-600/2-75-013-a (1975)	Andersen Model III Impactor	Coal-Fired Boiler	Baghouse (Pilot-scale) Reverse Air	86
36	McKenna, J. D., J. C. Mylock, and W. O. Lipscomb, "Applying Fabric Filtration to Coal-Fired Industrial Boilers," EPA-650/2-74-058-a (1975)	Andersen Impactor	Coal-Fired Stoker Boiler	Baghouse (Pilot-scale) Reverse Air	28

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
37	McKenna, J. D., J. C. Mylock, and W. O. Lipscomb, "Applying Fabric Filtration to Coal-Fired Industrial Boilers," EPA-650/2-74-058-a (1975)	Andersen Impactor	Coal-Fired Stoker Boiler	Baghouse (Pilot-scale) Reverse Air	7
38	McKenna, J. D., J. C. Mylock, and W. O. Lipscomb, "Applying Fabric Filtration to Coal-Fired Industrial Boilers," EPA-650/2-74-058-a (1975)	Andersen Impactor	Coal-Fired Stoker Boiler	Baghouse (Pilot-scale) Reverse Air	5
39	McKenna, J. D., J. C. Mylock, and W. O. Lipscomb, "Applying Fabric Filtration to Coal-Fired Industrial Boilers," EPA-650/2-74-058-a (1975)	Andersen Impactor	Coal-Fired Stoker Boiler	Baghouse (Pilot-scale) Reverse Air	11
40	McKenna, J. D., J. C. Mylock, and W. O. Lipscomb, "Applying Fabric Filtration to Coal-Fired Industrial Boilers," EPA-650/2-74-058-a (1975)	Andersen Impactor	Coal-Fired Stoker Boiler	Baghouse (Pilot-scale) Reverse Air	7
41	McCain, J. D., "Evaluation of Centrifield Scrubber," EPA-650/2-74-129-a (1975)	Andersen Impactor CNC/Diffusion Battery Whitby Electrical Analyzer, Model 3030 Brink Impactor	Asphalt Dryer	1. Coarse Cyclone 2. Secondary Collector 3. Scrubber (Novel Device)	31
42	Cooper, D. W., "Pentapure Impinger Evaluation," EPA-650/2-75-024-a (1975)	Andersen Impactor	Gray Iron Cupola	Pentapure Impinger (Novel Device)	12
43	Yost, K. J., et al., "The Environmental Flow of Cadmium and Other Trace Metals," Progress Report NSF (RANN) Grant GI-35106, Purdue University, West Lafayette, Indiana (1973)	Andersen Impactor	Zinc Coke Plant	None	1
44	Yost, K. J., et al., "The Environmental Flow of Cadmium and Other Trace Metals," Progress Report NSF (RANN) Grant GI-35106, Purdue University, West Lafayette, Indiana (1974)	Andersen Impactor	Zinc Vertical Retort	None	3

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
45	Yost, K. J. et al., "The Environmental Flow of Cadmium and Other Trace Metals," Progress Report NSF (RANN) Grant GI-35106, Purdue University, West Lafayette, Indiana (1974)	Andersen Impactor	Steel Mill Open Hearth Furnace	ESP	6
46	Yost, K. J. et al., "The Environmental Flow of Cadmium and Other Trace Metals," Progress Report NSF (RANN) Grant GI-35106, Purdue University, West Lafayette, Indiana (1973)	Andersen Impactor	Municipal Incinerator	Wet Scrubber	1
47	Brown, A., Jr. et al., ERDA Contract No. EX-7-6-C-01-2267	Andersen Model III Impactor	Industrial Boiler	None	3
48	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	UW Mark II Impactor Andersen Impactor	Urea Prilling Tower	None	12
49	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	Andersen Impactor Brink Impactor UW Mark III Impactor	Potash Dryer	Wet Scrubber	17
50	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	UW Mark III Impactor	Coal-Fired Utility Boiler	ESP and TCA Scrubber	6
51	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	Brink Impactor UW Mark III Impactor	Coal-Fired Utility Boiler	Venturi Scrubber	6
52	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	UW Mark III Impactor	Salt Dryer	Wetted Fiber Scrubber	16
53	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	UW Mark III Impactor	Salt Dryer	Impingement Plate Scrubber	12

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emission Source	Applied Control Equipment	Total No. of Runs
54	Calvert, S., N. J. Jhaveri, and S. Yung, "Fine Particle Scrubber Performance Tests," EPA-650/2-74-093 (1974)	UW Mark III Impactor	Gray Iron Cupola	Venturi Rod Scrubber	18
55	Calvert, S., et al., EPA-600/2-76-282 (1976)	UW Mark III Impactor	Gray Iron Cupola	Venturi Rod Scrubber	35
56	EPA Contract No. 68-02-1814, Bechtel Corporation, San Francisco, California	MRI Model 1502 Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Wet Scrubbers (Prototype)	101
57	EPA Contract No. 68-02-1814, Bechtel Corporation, San Francisco, California	MRI Model 1502 Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	TCA Scrubber (Prototype)	75
58	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Coal-Fired Industrial Boiler	None	1
59	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Residual Oil-Fired Industrial Boiler	None	5
60	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Residual Oil-Fired Industrial Boiler	None	2
61	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Residual Oil-Fired Industrial Boiler	None	1
62	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Residual Oil-Fired Industrial Boiler	None	3
63	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Coal-Fired Industrial Boiler	None	1
64	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Coal-Fired Industrial Boiler	None	3
65	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Coal-Fired Industrial Boiler	ESP	5
66	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Distillate Oil-Fired Industrial Boiler	ESP	2
67	Hunter, S. C., et al., EPA Contract No. 68-02-1074	Brink BMS-11 Impactor	Residual Oil-Fired Industrial Boiler	None	2

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
68	Ensor, D. S., et al., EPA-600/2-75-074 (1975)	Other Impactor Wire Screen Diff Battery	Coal-Fired Utility Boiler	Wet Scrubber	34
69	Schliesser, S. P., EPA Contract No. 68-02-2646	Brink BMS-11 Impactor UW Mark III Impactor	Coal-Fired Utility Boiler	Mobile High Voltage ESP (Pilot-scale)	79
70	Stanley, C., North Dakota Trip Report, Inter-Office Memorandum	Brink BMS-11 Impactor UW Mark III Impactor Other Impactors	Utility Boiler	Mobile High Voltage ESP (Pilot-scale)	30
71	Snyder, J. W., et al., EPA 68-02-1816, Report 5 (1977)	Andersen Model III Impactor Brink BMS-11 Impactor	Coal-Fired Utility Boiler	Mobile Fabric Filter (Pilot-scale)	18
72	Cavanagh, L. A., et al., Contract No. 37-28046 (1978)	SASS Train-With Cyclones	Residual Oil-Fired Utility Boiler	None	5
73	Bradway, R. M., et al., EPA-600/2-76-077A (1976)	Andersen Model III Impactor	Utility Boiler	Fabric Filter (Teflon-coated fiberglass) Reverse Air	38
74	Bradway, R. M., et al., EPA-600/2-76-077A (1976)	Andersen Model III Impactor	Utility Boiler	Fabric Filter (Teflon-coated fiberglass) Reverse Air	34
75	Bradway, R. M., et al., EPA-600/2 76-077A (1976)	Andersen Model III Impactor UW Mark III Impactor Rich 100-CNC	Utility Boiler	Fabric Filter (Teflon-coated fiberglass) Reverse Air	81
76	Cass, R. W., and J. E. Langley, EPA-600/7-77-023 (1977)	Andersen Model III Impactor UW Mark III Impactor Bausch and Lomb Model 40-1-OPC Rich 100-CNC	Electric Arc Furnace	Fabric Filter (Dacron)	339
77	Rei, M. T., and D. W. Cooper, EPA-600/2-76-202 (1976)	Andersen Model III Impactor Bausch and Lomb Model 40-1-OPC Rich 100-CNC	Laboratory Analysis	CHEAF Scrubber (Novel Device)	52
78	Dennis, R., et al., EPA-650/2-74-036 (1974)	Andersen Model III Impactor	Prototype Test	Sonic Agglomerator (Novel Device)	32
79	Werner, A. S., et al., EPA-600/7-76-017 (1976)	UW Mark III Impactor	Residual-Oil Utility Boiler	Cyclone	2

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
80	Nichols, G. B., et al., "Collection Efficiency on Three ESP," EPA-600/2-75-056, October 1975	Andersen Model III Impactor Brink BMS-11 Impactor Royco Model OPC Other-CNC	Rotary Kiln in Cement Manufacture	Dry ESP (plate)	22
81	Gooch, J. P., et al., SORI-EAS-76-421, Draft, September 1976	Andersen Model III Impactor Brink BMS-11 Impactor Whitby Electrical Analyzer, Model 3030	Coal-Fired Boiler	Dry ESP (plate)	42
82	Nichols, G. B., et al., SORI-EAS-76-511 (1976)	Brink BMS-11 Impactor	Copper Smelter	Dry ESP (plate)	8
83	Gooch, J. P., et al., EPA-600/2-76-141, May 1976	Brink BMS-11 Impactor UW Mark III Impactor Whitby Electrical Analyzer, Model 3030	Sulfate Pulping	Hi-Voltage ESP (plate)	23
84	Gooch, J. P., et al., EPA-600/2-76-141, May 1976	Brink BMS-11 Impactor UW Mark III Impactor	Sulfate Pulping	Hi-Voltage ESP (plate)	13
85	Nichols, G. B., and J. D. McCain, EPA-600/2-75-056 (1975)	Brink and Andersen Impactors	Unclassified Boiler	ESP	12
86	McCain, J. D., "Evaluation of Rexnorp Gravel Bed Filter," EPA-600/2-76-164 (1976)	Andersen Model IV Impactor Royco Model OPC Other-CNC	Clinker Cooler in Cement Manufacture	Gravel Bed Filter (Novel Device)	49
87	Harrisburg Municipal Incinerator EPA 68-02-0284	Andersen Mark III Impactor Brink BMS-11 Impactor	Solid Waste Incinerator	Dry ESP	10
88	McCain, J. D., SORI-EAS-73-052 February 1973	Other	Ceramic/Clay Dryer	Cyclone	6
89	Gooch, J. P., and G. B. Nichols, SORI-EAS-77-098 EPRI-RP413-1 (1977)	Andersen Model III Impactor Whitby Electrical Analyzer, Model 3030 Other	Pulverized Coal-Fired Utility Boiler	Dry ESP (plate)	34
90	EPA Contract No. 68-02-1869	UW Mark III Impactor	Mineral Process	Venturi Scrubber	25
91	EPA Contract No. 68-02-1869	UW Mark III Impactor, Wire Screen Diff. Battery	Gray Iron Cupola	Venturi Scrubber	53
92	Electrified Bed Evaluation, EPA-600/7-78-178 (1978)	Andersen Model III Impactor	Asphalt Roofing	Electrified Bed (Prototype)	12
97	Confidential	MRI Model 1502 Impactor	Bark/Oil-Fired Industrial Boiler	Cyclone	7

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
98	EPA Contract 68-02-1816, Monsanto Report, March 1975	Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	1
99	EPA Contract 68-02-1816, Monsanto Report, March 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	4
100	EPA Contract 68-02-1816, Monsanto Report, March 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	5
101	EPA Contract 68-02-1816, Monsanto Report, March 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	18
102	EPA Contract 68-02-1816, Monsanto Report, March 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	24
103	EPA Contract 68-02-1816, Monsanto Report, March 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Pulverized Coal-Fired Utility Boiler	Mobile Fabric Filter (Novel Device)	14
104	EPA Contract 68-02-1816, Monsanto Report, October 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Sulfate Pulping Kiln	Mobile Fabric Filter (Novel Device)	23
105	EPA Contract 68-02-1816, Monsanto Report, October 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Wood Pulping Kiln	Mobile Fabric Filter (Novel Device)	22
106	EPA Contract 68-02-1816, Monsanto Report, October 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Wood Pulping Kiln	Mobile Fabric Filter (Novel Device)	41
107	EPA Contract 68-02-1816, Monsanto Report, October 1975	Andersen Model III Impactor Brink BMS-11 Impactor	Wood Pulping Kiln	Mobile Fabric Filter (Novel Device)	12
108	Confidential	Other Impactor Other-OPC	Coke-Fired Utility Boiler	None	8
109	Confidential	Other Impactor	Unclassified Boiler	Cyclone, Fabric Filter	9
110	Confidential	Andersen Model II Impactor	Metals Process	Afterburner	2
111	Confidential	Other Impactor Other-OPC	Coal-Fired Stoker Boiler	Cyclone	20
112	Coal and Refuse Test, SORI-EAS-75-316, June 1975	Andersen Model III Impactor Other Other Impactor	Solid Waste/Coal-Fired Utility Boiler	ESP	55
113	Confidential	Brink BMS-11 Impactor	Steel Foundry	Mechanical Cyclone	7

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
114	McCain, J. D., and W. B. Smith, Final Report, SORI-EAS-74-158	Andersen Mark III Impactor	Utility Boiler	Cyclone	7
115	McCain, J. D., et al., SORI-EAS-74-418, December 20, and SORI-EAS-75-062, February 10	Andersen Mark III Impactor Other Impactor Other-OPC	Coal-Fired Utility Boiler	ESP	71
116	Bird, A. N., SORI-EAS-73-124, June 20, 1973	Brink BMS-11 Impactor	Coal-Fired Utility Boiler	Wet Scrubber (Pilot-scale)	12
117	Bird, A. N., SORI-EAS-73-200	Brink BMS-11 Impactor Climet Model-OPC Other-CNC	Steel Foundry	Hood Ducts	8
118	Nichols, G. B., SORI-EAS-74-009, 3155-IF, March 12, 1974	Andersen Model III Impactor Brink BMS-11 Impactor	Unclassified Boiler	ESP	10
119	Nichols, G. B., Company Correspondence, A1402-3005-IF, November 13, 1972	Brink BMS-11 Impactor	Unclassified Boiler	ESP	6
120	Nichols, G. B., and J. D. McCain, EPA-600/2-75-056, October 1975	Andersen Mark III Impactor Other	Unclassified Boiler	Dry ESP	24
121	Nichols, G. B., and J. P. Gooch, A1364-2975, October 1972	Brink BMS-11 Impactor	Unclassified Boiler	ESP	10
122	Gooch, J. P., and C. H. Marchant, SORI-EAS-77-476, EPRI-RP413-1 (1977)	Andersen Model II Impactor Brink BMS-11 Impactor	Unclassified Boiler	ESP	48
123	McCain, J.D. SORI-EAS-73-127, (1973)	Andersen Model II Impactor Brink BMS-11 Impactor	Mineral Process	Cyclone	8
124	McCain, J. D. SORI-EAS-73-127, (1973)	Andersen Model II Impactor Brink BMS-11 Impactor	Mineral Wool Cupola	Cyclone	6
125	Gooch, J. P., and C. H. Marchant, SORI-EAS-77-476, EPRI-RP413-1 (1977)	Andersen Model III Impactor Brink BMS-11 Impactor	Unclassified Boiler	ESP	24
126	Gooch, J. P., and C. H. Marchant, SORI-EAS-77-476, EPRI-RP413-1 (1977)	Andersen Model III Impactor Other Impactor	Unclassified Boiler	ESP	64

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
127	Dismukes, E., SORI-EAS-75-311, EPA-600/2-75-015 (1975)	Andersen Impactor Other-CNC	Unclassified Boiler	ESP (Prototype)	15
128	Dismukes, E., SORI-EAS-75-311, EPA-600/2-75-015 (1975)	Andersen Model III Impactor Other-CNC	Unclassified Boiler	ESP (Prototype)	47
129	Evaluation of ESP During SRC Combustion, EPA-600/7-78-129 (1978)	SASS Train-With Cyclones Other Impactor	Unclassified Boiler	Hi-Voltage ESP	16
130	CEA Variable-Throat Venturi Scrubber, EPA-650/7-78-094 (1978)	Brink BMS-11 Impactor UW Mark III Impactor	Pulverized Coal-Fired Utility Boiler	Venturi Scrubber (Novel Device)	24
131	Gooch, J. P., et al., SORI-EAS-75-622 (1975)	Andersen Model III Impactor Brink BMS-11 Impactor	Unclassified Boiler	ESP	21
132	Gooch, J. P., and G. H. Marchant, SORI-EAS-77-476, EPRI-RP413 (1977)	Andersen Model II Impactor Other Impactor	Unclassified Boiler	ESP	37
133	McCain, J. D., SORI-EAS-76-355 (July 15, 1976)	Brink BMS-11 Impactor and Andersen Model III Impactor	Unclassified Boiler	Hot side ESP	18
134	Evaluation of ESP During SRC Combustion, EPA-600/7-78-129 (1978)	SASS Train-With Cyclones Other Impactor	Unclassified Boiler	Hi-Voltage ESP	14
137	Bryant, H. A., United McGill Corp. Report (December 14, 1976)	Sierra C-226 Impactor	Wood Waste Industrial Boiler	Mobile ESP (plate)	7
138	Confidential	MRI Model 1502 Impactor Other Impactor	Wood Waste Boiler	Cyclone	15
139	Nelson, P. A., Dept. of Ecology	Other Impactor	Aluminum Metal Process	None	3
140	Nelson, P. A., Dept. of Ecology	Other Impactor	Unclassified Boiler	None	2
141	Nelson, P. A., Report No. 76-14 (1976)	Other Impactor	Wood Waste Utility Boiler	None	2
142	EPA Contract No. 68-01-3155 Task No. 1 (August 1976)	Andersen Model III Impactor	Metallurgical Coke-Oven Pushing	Cyclone	3

FPEIS Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
143	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Unclassified Boiler	None	4
144	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Copper Smelter	ESP	4
145	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Cyclone	4
146	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	None	7
147	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Copper Smelter	Pilot Baghouse	3
148	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Kraft Recovery Boiler	None	2
149	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Exhaust Blower	1
150	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Cyclone	2
152	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Cyclone	1
154	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Cyclone	3
155	Nelson, P. A., Department of Ecology, Washington	Other Impactor	Grain Processor	Cyclone	1
156	Nelson, P. A., Department of Ecology, Washington	Other Impactor	AL ORE-ELECROEDN HORIZSTD SODERBURG	None	2
157	EPA Contract No. 68-02-2144 Location 3	Brink BMS-II Impactor	Gas-Fired Cement Kilns	Reverse Air Baghouse, Multiclone	1
158	EPA Contract No. 68-02-2144 Location 9	Brink BMS-II Impactor	Gas-Fired Cement Kilns	Wet, Hot side Low-Voltage ESP	2
159	EPA Contract No. 68-02-2144 Location 9	SASS Train-With Cyclones	Gas-Fired Cement Kilns	Wet, Hot side Low-Voltage ESP	4

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
160	EPA Contract No. 68-02-2144 Location 10-1	Brink BMS-11 Impactor	Wood Waste Industrial Boiler	Multiclone, Variable-Throat Venturi Scrubber	1
161	EPA Contract No. 68-02-2144 Location 10-2	SASS Train-With Cyclones	Unclassified Boiler	Wet, Hot side ESP	4
162	EPA Contract No. 68-02-2144 Location 12	SASS Train	Petroleum Process Heater	None	2
163	EPA Contract No. 68-02-2144 Location 13	SASS Train-With Cyclones Brink Model B Impactor	Wood Waste Industrial Boiler	Multiclone	3
164	EPA Contract No. 68-02-2144 Location 14	SASS Train	Oxlance in Steel Production	Dry, Cold side, High-Voltage ESP	1
165	EPA Contract No. 68-02-2144, Location 15	Andersen Model III Impactor SASS Train-With Cyclones	Internal Combustion with Diesel Fuel	None	3
166	EACCS (EPA 68-02-2197)	SASS Train-With Cyclones	Pulverized Coal-Fired Utility Boiler	Multiclone	1
167	EACCS (EPA 68-02-2197)	SASS Train-With Cyclones	Pulverized Coal-Fired Utility Boiler	Multiclone	1
168	EACCS (EPA 68-02-2197)	SASS Train-With Cyclones	Stoker-Fired Utility Boiler	Multiclone	1
169	EPA-600/7-78-164c (August 1978)	Other Impactor Other-OPC	Pulverized Coal-Fired Industrial Boiler	Variable-Throat Venturi Scrubber (Pilot-scale)	2
170	EPA-600/7-78-164c (August 1978)	Other Impactor Other-OPC	Residual Oil-Fired Industrial Boiler	Dual Throat Venturi Scrubber (Pilot-scale)	4
171	Contract 68-02-2613, Task No. 8, Draft Report	MRI Impactor Other-OPC	Cyclone-Fired Utility Boiler	Wet Scrubber	2
186	Cavanagh, L. A., et al., Contract No. J7-28046, January 1978	SASS Train-With Cyclones	Residual Oil-Fired Utility Boiler	None	4
187	Cavanagh, L. A., et al., Contract No. J7-28046, January 1978	SASS Train-With Cyclones	Residual Oil-Fired Utility Boiler	None	8

FPEIS Test Series No.	Data Reference	Sampling Equipment	Emissions Source	Applied Control Equipment	Total No. of Runs
188	Cavanagh, L. A. et al., Contract No. J7-28046, January 1978	SASS Train-With Cyclones	Residual Oil-Fired Utility Boiler	None	6
189	Confidential	UW Mark III Impactor Other Impactor	Coal-Fired Utility Boiler	ESP (plate)	11